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University of Information Technology & Sciences (UITS)

Faculty of Science and Engineering

Department of Computer Science and Engineering

Program: B.Sc. in CSE

Term Final Examination, Autumn 2025

Course Title: Discrete Mathematics

Course Code: CSE0541123

Marks: 50 **Time: 3*(three)* hours**

(Answer all questions)

Q. No.			Marks
1.	a)	Let Q(x,y) be the statement "x + y = x − y" If the domain for both variables consists of all integers, **find** the truth values of the following compound propositions - a) Q(1,1) b) ∀yQ(1,y) c) ∃x∃yQ(x,y) d) ∃y∀xQ(x,y) e) ∀x∀yQ(x,y)	[05]
	b)	**Translate** these statements into English, where C(x)is "x is a comedian" and F(x)is "x is funny" and the domain consists of all people. a) ∀x(C(x) → F(x)) b) ∃x(C(x) → F(x)) c) ∀x(C(x) ∧ F(x)) d) ∃x(C(x) ∧ F(x)) e) ¬ ∃x(C(x) ∧ F(x))	[05]
2.	a)	**Construct** a truth table for the following compound proposition $(p \rightarrow q) \wedge (\neg p \rightarrow r)$	[05]
	b)	**Calculate** the **first five** terms of the sequence defined by the following recurrence relation and initial condition. $a_n = na_{n-1} + n^2 a_{n-2}$ where $a_0 = 1$, $a_1 = 1$	[05]
3.	a)	Let P = {2, 4, 6, 8, 10, 12} and Q = {4, 5, 8, 11, 13}. **Find** the following - a) P ∪ Q b) P ∩ Q c) P − Q d) Q − P e) (P − Q) ∪ (Q − P)	[05]

b) **Prove** that for any integer n there is a decimal integer containing only digits 0 and 1 which is divisible by n. **[05]**

4. a) Consider the following congruences – **[05]**

$x \equiv 4 \pmod 6$ $x \equiv 2 \pmod 9$ $x \equiv 5 \pmod 7$

Calculate the value of x using Chinese Remainder Theorem.

b) **Apply** shift cipher method with shift key k = 3 to produce the secret message for "HAVE A GOOD DAY". **[05]**

5. a) **Apply** the Bubble Sort algorithm to put **6, 2, 4, 9, 1, 5** into increasing order. Show steps with proper diagram. **[05]**

b) **Describe** the concept of "Graph" and **explain** the following types of graphs with suitable diagrams – **[05]**

i. Weighted graph

ii. Complete graph